L3 ANSWER 11 OF 19 CAPLUS COPYRIGHT 2003 ACS
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DN 117:262441
TI Metallic impurities segregation at the interface between silicon wafer and liquid during wet cleaning
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CODEN: JESOAN; ISSN: 0013-4651
DT Journal
LA English
CC 76-3 (Electric Phenomena)
Section cross-reference(s): 66
AB An extensive lecture with 21 refs. on Si wafer surface cleaning and metallic impurities adsorption and segregation at its surfaces, considering relative electronegativities. The ultraclean wafer surface must be perfectly free from particles, org. materials, metallic impurities, native oxides, surface microroughness, and adsorbed mol. impurities. Metallic contamination, the major type of contaminants to be overcome, has a fatal effect on device characteristics and must be suppressed to at least below 1010 atom/cm2. The current dry processes, such as reactive ion etching or ion implantation, cause metallic contamination as high as 1012-1013 atom/cm2. The wet process becomes increasingly important to remove these metallic impurities introduced during dry processing. Employing a new evaluation method, the metallic impurity segregation at the interface between the Si wafer and the liq. in the wet cleaning process was studied. It has been found that metals, such as **Cu** having higher electronegativity than Si, are directly adsorbed on the Si surface by taking an electron from the Si. On the other hand, metals, such as Fe and K having lower electronegativity than Si, are not adsorbed on the Si surface. In the normal wet cleaning process when a native oxide is formed on the Si surface, metals such as Fe and K that are oxidized more easily than Si, are preferentially included into the native oxide. When the metals are in **ultrapure water** or chems. with a concn. of 1 **ppb**, they are included into the Si surface, and native oxide with evaluation was 1012-1013 atom/cm2. Therefore, to decrease the metallic contamination level on the Si surface to levels less than 1 .times. 1010 atom/cm2, the metallic impurities must be suppressed to at least below the 1 ppt level in **ultrapure water** and high-purity HF, which are employed in the final step of the cleaning process. To prevent the metallic contamination on the wafer surface, it was found that it is important to maintain an inert atm., such as N2 or Ar, to suppress native oxide growth and to reduce metallic impurities in the **ultrapure water** rinse. Moreover, it has been found that the dild. HF-H2O2 cleaning is effective in removing metals such as **Cu**, having high electronegativity, from the Si surface at room temp. and that it does not induce surface microroughness. This means the dild. HF cleaning, which has been employed in the final step of the conventional wet cleaning process to remove the native oxide, needs to be replaced with the dild. HF-H2O.infin. cleaning. It was also found that surfactants added to improve the wettability of chems. on the Si surface were also able to prevent metallic impurity pptn. on the wafer surface.
ST silicon surface metal electronegativity segregation; metal impurity adsorption silicon electronegativity; cleaning wet silicon surface metallic impurity
IT Adsorption
(of metallic impurities, on silicon wafer surface and interfaces, electronegativity in)
IT Adhesion
(of metallic impurities, on silicon wafer surface, electronegativity

in)
IT Electronegativity
(of metallic impurities, segregation and adsorption at silicon surface in relation to)
IT Cleaning
(of surface from metallic impurity, electronegativity effect on)
IT 7664-39-3, Hydrofluoric acid, uses 7722-84-1, Hydrogen peroxide, uses
RL: USES (Uses)
(in silicon surface cleaning, from metallic impurities)
IT 7440-21-3, Silicon, properties
RL: PRP (Properties)
(metallic impurity at surface of, electronegativity effect on)
IT 7664-39-3, Hydrofluoric acid, uses 7664-93-9, Sulfuric acid, uses
RL: USES (Uses)
(silicon surface cleaning by, from metallic impurities , electronegativity in)
IT 7439-89-6, Iron, uses 7440-02-0, Nickel, uses 7440-50-8, **Copper**, uses 7440-66-6, Zinc, uses
RL: USES (Uses)
(silicon surface cleaning from impurities of, wet, relative electronegativity in)

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FILE 'CAPLUS, JAPIO' ENTERED AT 10:20:49 ON 10 JUN 2003

L1	3283	S	(ULTRAPURE OR ULTRA (W) PURE)(2W) WATER
L2	186	S	L1 AND (COPPER OR CU)
L3	19	S	L2 AND PPB
L4	56	S	L2 AND CONCENTRATION
L5	49	S	L4 NOT L3
L6	0	S	L5 AND BILLION
L7	24	S	UPW AND (COPPER OR CU)
L8	1	S	L7 AND PPB